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ABSTRACT

Mathematics has its own unique vocabulary as well as words which cut across all academic disciplines. It also has abstract symbols which belong to mathematics solely. Words and symbols need to be read meaningfully by students. Along with reading, mathematics teaching stresses the use of a variety of learning opportunities to guide students to attain worthwhile objectives. Developmental concrete, semiconcrete, and abstract experiences are needed to provide for individual differences among students in the classroom. This paper focuses on reading and word problems in math, suggesting that the teacher might assist students who have difficulties in word identification by instructing in the use of context clues. The paper states that once correct word identification and comprehension are present, students may need assistance in determining what is asked for in the word problem. It also discusses criteria for mathematics teaching and objectives, testing, and mathematics achievement. The paper notes that a relaxed environment must be present in the classroom, so that students may achieve and not worry or feel uneasy about the classroom climate. (NKA)

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Reading, Mathematics, and Thought.

by Marlow Ediger

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Reading, Mathematics, and Thought

Reading across the curriculum is salient to emphasize. The mathematics curriculum certainly can provide its many contributions in helping pupils in learning to read and read well. When teaching on the junior high school level, the author noticed that many pupils could not do word problems well because of reading problems. Mathematics does have its own unique vocabulary as well as words which cut across all academic disciplines. It also has abstract symbols which belong to mathematics solely. Words and symbols need to be read meaningfully by pupils. The following words are in common use in mathematics: addition, subtraction, multiplication, division, commutative, associative, distributive, algebra, equations, among many others. Common symbols which pupils need to read in an understanding manner include the following: " - ," " +," "x," " <," among a plethora of others. Along with reading, mathematics teaching stresses the use of a variety of learning opportunities to guide pupils to attain worthwhile objectives. Developmental concrete, semiconcrete, and abstract experiences are needed to provide for individual differences among pupils in the classroom. Each needs to achieve as optimally as possible.

Reading and Word Problems

The adopted basal textbook in mathematics provides many learning opportunities for pupils. A the same time, it is difficult to appreciate by many pupils unless a considerable amount of help is given by the teacher to make subject matter meaningful. Word problems, in particular, may prove complex for many to solve. Recognition of selected words might indeed cause difficulties for those who read below grade level. The teacher may read aloud those word problems causing difficulties to a small group of pupils. It is imperative that these pupils follow along in their basals as the content is being read aloud. By looking carefully at each word read aloud, the pupil can learn to identify new words and have them become a part of the child's basic sight vocabulary. The next time that these same words are met in print, hopefully the learner will be able to recognize each immediately. Peer teaching might also be used in that a good reader reads aloud the word problems from the text to others in the small group who need this assistance. Rearranging pupils into small groups for necessary instructional purposes may be done

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quietly and quickly so as not to interrupt others. The regrouping should also be done so as not to defame or minimize any pupil. Pupils need to feel accepted and have feelings of belonging within a group. They need to be given the best instruction possible. Many times, a slow reader can solve word problems correctly after the words become meaningful.

The teacher might assist pupils who have difficulties in word identification by giving instruction in the use of contest clues. A pupil might be substituting a ridiculous word for an unknown word. Here, the teacher must guide the pupil to make rational choices as to using sensible words in place of the unknown. Should this not be adequate, the pupil's attention should be placed upon the initial consonant of the unknown word. Many consonants are consistent between symbol (grapheme) and sound (phoneme). The help given pupils in using context clues and phonics should assist pupils to achieve more optimally in mathematics. If more assistance is needed in identifying unknown words, the teacher, perhaps, should give help in pupils looking at ending consonants to identify the unknown word and medial vowel letters.

Reading of sentences in mathematics might cause difficulties due to a lack of concentration by the pupil. For example, when supervising university student teachers in the public schools, the author noticed pupils who could pronounce most of the words correctly in word problems, but did not comprehend that which was read. Concentration on the task at hand is very important and the teacher needs to assist pupils to comprehend what is read. This can be done by asking the pupil the meaning of subject matter read. This will take time since the pupil has not related reading to comprehending. Word calling is then in evidence. Calling words has little relevance unless the learner understands subject matter read. By working with the child, he/she can learn to comprehend and not only call words. An aide or a high school student in Future Teachers of America may also assist in having the word caller say in his/her own words that which was read.

Once correct word identification and comprehension are there, pupils may need assistance in determining what is asked for in the word problem. A word problem may have several steps to pursue in having the learner arrive at a successful answer or solution. Each of these steps need analyzing in coming up with a correct answer. Creativity is then needed to synthesize, after analyzing the contents of the problem. Pupils need to be taught reasons for analysis, synthesis, and creativity in problem solving. Once the rationale is taught to pupils, it is easier to

perceive reasons for engaging in each step of problem solving. These reasons or purposes need to be uppermost in the minds of children. The teacher can teach pupils to use mathematics in a mechanical way, but then difficulties accrue in not being able to solve problems when unique ways have been used in writing these problems. Problem solving should stress something novel which causes pupils to think. Thinking involves facing a perplexity in which "the tried and true" which have been used previously might not work, but there is still a pattern involved in problem solving in that

* the problem needs clear identification. Information for the problem must be selected which will make for a possible solution.
* an hypothesis is developed based on information acquired.
* the hypothesis is tentative and needs checking.
* if upheld, the hypothesis stands as is. If not, the hypothesis is rejected and needs modification and change (Ediger and Rao, 2003, Chapter Twelve).

Criteria for Mathematics Teaching

There are selected criteria which need emphasizing in ongoing mathematics units of study:

* Each word problem should be made as concrete as possible with markers, diagrams, and drawings used to make subject matter meaningful.
* adequate readiness should be provided for an ensuing learning opportunity. The readiness provides the necessary background information for problem solving.
* appropriate sequence must be provided so that each previous learning provides background information for the new subject matter encountered.
* active engagement of learners is needed so they might benefit more optimally from the new content. A hands on approach in developing mathematics concepts and generalizations should be stressed.
* interest in learning must be acquired so that pupils enjoy and appreciate mathematics as an academic branch of knowledge.
* purpose in problem solving should be stressed so that each pupil sees and perceives the "why" for problem solving.
* the needs of learners must be met in terms of developing feelings of belonging, security, and esteem. Pupils have feelings whereby they desire to be treated as human beings having worth

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when working individually, in small groups, and in the class as a whole.

* understanding of what is taught is a must; otherwise, subject matter could be committed to memory and soon forgotten in whole or in part.

* application of what has been learned is important. Pupils must perceive that subject matter learned is useful, rather than being learned for its own sake.

* self assessment of progress in mathematics is salient. The pupil then determines what is known and what is left to learn.

* reflective thinking needs adequate emphasis so that the pupil rehearses that which has been learned. These learnings will be remembered more thoroughly due to review involving mathematical learnings.

* logical thinking is an important goal in mathematics thinking. Much work in mathematics involves logical thought (Ediger and Rao, 2000, Chapter Eighteen).

The teacher needs to follow the above named criteria in teaching pupils so that each might well achieve as optimally as possible. The achievement should focus on objectives for pupil attainment.

Objectives, Testing, and Mathematics Achievement

Each state, except Iowa, has mandated objectives for pupils to achieve. These objectives are generally available to teachers as benchmarks for instruction. The teacher selects the learning opportunities to align with the stated objectives. The state has developed mandated test to administer to pupils. They generally have been pilot tested to take out kinks or weaknesses. The accompanying tests need to match up with the accompanying objectives of instruction. If they do cover what is in the objectifies, then validity might well be in evidence. Reliability in the test items must also be in evidence in that there is consistency in each pupil's test results, in the pilot study, be it test/retest, alternate forms, or split half reliability. The state mandated tests are to be given in mathematics and in reading in grades 3- 8, and 10.

State mandated objectives in mathematics are usually written in measurable terms. Either a pupil does/does not achieve any one objective as a result of instruction. The mathematics test contains considerable reading when word problems are listed. Computation also involves reading. There are numerals and mathematical symbols to read. Verbal and

logical intelligences are used by pupils when taking the test. The state mandated tests would fit into being criterion referenced. The objectives have been written on the state level and are available to teachers to be used in instruction. These objectives are used as benchmarks for instruction. Theoretically many pupils can be successful and reach the top in goal achievement since the purpose of criterion referenced tests is not to spread pupils out on a continuum, but teachers are to assist pupils achieve optimally so the possibility for all to score high is possible. The objectives, available to pupils, are available to teachers to provide direction for instruction.

A few states use norm referenced, or standardized tests, whereby the pupils having taken the test are spread out from high to low. Thus, in pilot studies, the test writers, based on feedback from pupil test results, write multiple choice items which spread pupils out from the first to the ninety-ninth percentile. This makes it possible to make comparisons among school districts within a state. Those schools which have had high rates of pupil failure, based on state standards for two consecutive years in a row, might be taken over by the state.

The National Council for Teachers of Mathematics (NCTM) in 1989 developed a very comprehensive list of objectives for pupil attainment. These objectives may well be used by the teacher as standards for pupils to achieve. The following are standards pertaining to numbers and numeration for pupils in kindergarten through grade four to achieve:

Standard six: number sense and numeration

In grades, K- 4, the mathematics curriculum should include whole number concepts and skills so that pupils

* construct number meanings through real world experiences and the use of physical materials
* understand our numeration system by relating counting, grouping, and place value concepts
* develop number sense
* interpret the multiple uses of numbers encountered n the real world (NCTM, 38).

In addition to reading word and computation problems, the following are good to use as manipulatives in hands on mathematics learning:

* attribute blocks consisting of different geometric shapes and colors
* interlocking counting cubes
* measuring instruments to determine length, width, area, volume, weight, and temperature readings.

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* math boxes containing a variety of small objects and items to be used in counting, adding, subtracting, multiplying, and dividing.

* base ten place value charts, as well as base five and base two

* materials to use in teaching fractions such as circles, squares, and rectangles, to show halves, thirds, fourths, fifths, and eighths.*

* play money (coins and bills)

* geometric models such as spheres, hemispheres, pyramids, rectangular solids, cubes, triangular solids, cones, and cylinders

* geoboards with nails hammered in plywood in a six by six array. A rubber band can be stretched around these nails to make a rectangle, square, and triangle, among others

* calculators, computers with accompanying software pertaining to tutorials, analysis and remediation, drill and practice, games, and simulation

* protractors and compasses (See Kennedy and Tipps, 1991).

A variety of developmental learning opportunities need to be in the offing for pupils. There may be teacher directed leanings for pupils, teacher/pupil planning of experiences, as well as individual pupil choices as to what to learn when selections are made from learning centers. A relaxed environment must be there, so that pupils may achieve and not worry or feel uneasy about the classroom climate. The teacher is there to encourage, assist, and help pupils achieve and make progress.

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